FALCONS REJECT UNFAMILIAR PREY[1]

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The factors controlling predation are complex and currently not well understood. Variables are involved that pertain individually to the predator and to the prey and their interaction contribute to the probability of an attack. Much experimental work investigating predation has centered about factors dealing mainly with the prey item. For example, prey movement is known to be important in controlling the predatory activity of a variety of raptors (e.g., Metzgar 1967, Sparrowe 1972, Kaufman 1974b, Snyder 1975). Oddity has been implicated (Mueller 1974, 1975), as has a factor called novelty (Coppinger 1969, 1970). Color (Cushing 1939, Kaufman 1974a), conspicuousness in terms of contrast with substrate (Mueller 1968, Kaufman 1972, 1973), and searching image (Tinbergen 1960, Mueller, 1971, 1974) are other variables often manipulated. It is infrequent, however, that the interaction of variables is studied extensively within a single experiment. However, Ruggiero (1975) and Snyder (1975) have looked at some such interactions, and the present paper summarizes part of an extensive experiment (Ruggiero, Cheney and Knowlton, 1979,) emphasizing the importance of prey characteristic (i.e., color, movement, etc.) interaction in determining probability of prey selection by American Kestrels (*Falco sparverius*).

Methods

Using outdoor aviaries (6×3×3 m with solid gridded sides, rodent-proof bases, and dark brown peat-moss substrates) and four wild-caught (experience unknown) adult kestrels, we attempted to assess the influence of some interacting prey (mouse) characteristics on predatory selection. The independent variables of this study (see table 1) included prey movement (aberrant movement induced by drug injection, normal movement, or no movement), pelage color (white or black), and morphology (familiar or artificially made unfamiliar). Table 1 describes in detail each treatment of each variable. The familiarity variable was represented by prey items that were made morphologically discontinuous with the bird's probable prior experience (i.e., they were created so as to be novel). It is difficult to alter the appearance of a mouse to that which is clearly novel without also changing either its size or its carriage. Pilot investigation, however, determined that "extending" the tail with yarn the same color as the mouse and adding a similarly colored cotton ball on the mouse's back did alter morphology so as to in fact create sufficient novelty. We realize, however, that any stimulus is novel or unfamiliar only at first exposure. After that the object is simply more or less familiar. Treatments were affected, and prey items defined as per table 1, with each prey item displaying one treatment per variable.

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All possible treatment combinations of the 12 types of mice (*Mus musculus*) were presented by the experimenter simultaneously in pairs, to the four kestrels (two males and two females) one trial per day. Sequences of 16 trials for birds 5 and 6 and 17 for birds 3 and 4 provided 66 total experimental trials. The mice were released (or placed, when they were dead) 3.5 m in front of the kestrels' 1.5-m-high perch. The experimenter then left the enclosure and, with an observer, recorded time required by the Kestrel to choose (kill), which item of the two was selected, prey position when struck, and prey preattack movement. Mouse movement was scored as not active, moderately active, active, and very active based on the number of grids crossed prior to selection. Some mice were injected with pentobarbital (see table 1) so as to induce abnormal movement. These treated mice moved in a qualitatively different manner from noninjected mice in that they tended to stagger and sway, they groomed the injection site, and they appeared overtly awkward. There were no significant differences in quantity of movement between aberrant or normal mice (movement variable) or between black and white as determined by number of grid lines crossed.

Table 1. Independent Variables and Treatments for Prey Characteristics

Prey variables	Treatment	Characteristic
Movement	No movement	Dead mouse
	Aberrant movement	Mouse injected with .olcc/ 6g body wt. 25% sodium pentobarbital (Nembutal)
	Normal movement	Untreated
Pelage color	White	White-pelaged lab mouse
	Black	Black-pelaged lab mouse
Morphology	Familiar morph	Normal mouse without treatment or modification
	Unfamiliar morph (smaller mice were used in this category to equate overall apparent size)	A mouse with a 7.5 cm piece of black or white yarn tied to its tail and a 1.2-cm black or white cotton ball affixed to its back.

The 66 total experimental trials defined a balanced $2 \times 2 \times 3$ factorial design (Cochran and Cox 1957). The data presented here represent the pooled selection preferences of all four kestrels. These preferences were found to be a consistent (predictable) as opposed to a random, scheme (the coefficient of consistence measure zeta = 0.64; X^2 = 15.00; Kendall 1948). There was no significant preference for presentation side, location, or proximity. Birds would take mice wherever they were in the arena.

There was a significant interaction ($p = 0.01$; $X^2 = 15.04$) between movement and morphology, indicating that these variables did not act independently. Selection was very low for a moving, unfamiliar (because of either color or morphology) mouse and very high for a moving, familiar (either black or familiar) prey. Significant within-variable differences were also found for pelage color and morphology, but no other significant interactions occurred. Black pelage was selected significantly more than was white even on the dark substrate, and familiar morph prey were selected significantly more than unfamiliar ($p = 0.01$; $X^2 = 7.84$ for both within variable tests). This rejection of color and novel morphology supports Coppinger (1969, 1970) but is not in agreement with Mueller (1974, 1975). Birds were observed actually to retreat from a moving, white, unfamiliar morph. The interaction of all other prey characteristics with movement was very pronounced and tended to render unfamiliar prey even less desirable. Black pelage and familiar morphology were maximally selected when in combination with aberrant movement. All three of these variables could have occurred in combination in nature and therefore were not considered novel in this experiment. Movement of any kind enhanced selection for familiar prey and reduced selection for unfamiliary prey.

Discussion

The results of this study are considered further evidence that (1) prey movement is a most important factor in kestrel predation; (2) aberrant movement is a more effective attack stimulus than is normal movement; (3) prey items that are not discontinuous with a kestrel's experience are selected significantly more readily and often; (4) oddity, if it means novelty, reduces probability of attack; however, when the term *oddity* refers to "not matching" a simultaneously presented prey array, other factors are involved; (5) it is not the general case that raptors select prey solely on the basis of conspicuousness, i.e., such selection is not indicated when conspicuous prey are also unfamiliar in some aspect; (6) analysis for potential interaction is very important in this type of research; and (7) predator experimental and preexperimental experience is critical in assessing the influence of prey characteristics in selection experiments inasmuch as initially unfamiliar or novel stimuli become more familiar as a function of exposure.

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AN OCTAGONAL BAL-CHATRI TRAP FOR SMALL RAPTORS

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Several modifications of the bal-chatri trap for birds of prey have been used, most of which are described in the 1977 *North American Bird Banding Manual* (Vol. II: *Bird Banding Techniques*). Among these are the cylinder type (Berger and Mueller 1959, Mersereau 1975), the quonset or hemi—cylindrical type (Berger and Hamerstrom 1962, Berger and Mueller 1959, Mersereau 1975, Ward and Martin 1968), the box type (Clark 1967, Lohrer 1974, Mersereau 1975), and the cone and cube types (N. American Bird Banding Man. 1977). We have been using an octagon type of modified bal-chatri trap for several years, of a design quite different from any of the types listed above.

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